NC STATE UNIVERSITY

scope

FALL/WINTER 2005

A LOOK INSIDE THE COLLEGE OF PHYSICAL AND MATHEMATICAL SCIENCES

Predicting how disease spreads

This mathematician is developing network models that will predict how disease spreads through populations, critical in handling outbreaks of bio-terrorism, influenza or other infectious diseases.

A powerful vision

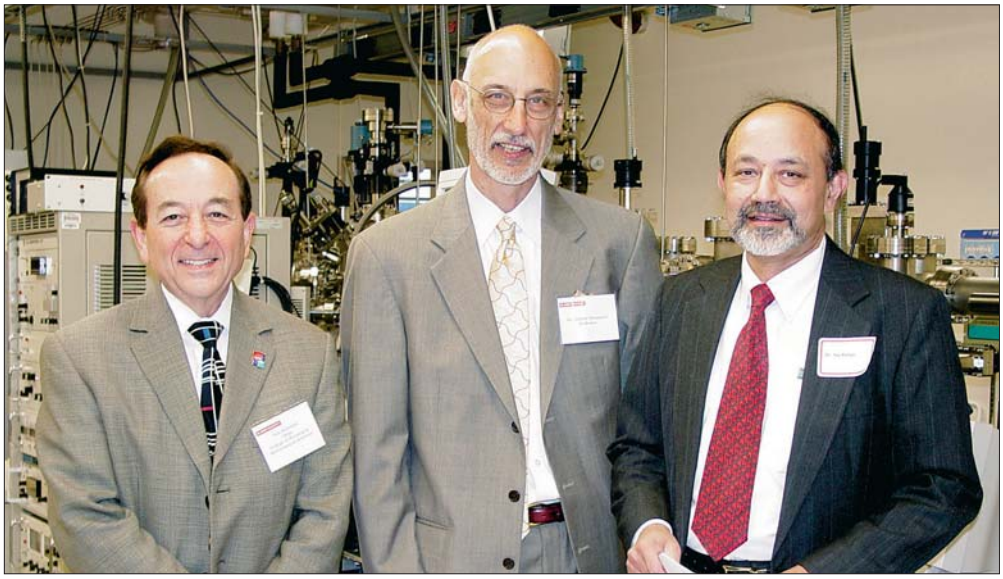

PHOTO BY SALLY RAMEY

Dean Dan Solomon, Dr. Robert Nemanich and Dr. Jay Baliga visit one of Nemanich's new physics laboratories in Partners III on Centennial Campus. (see related story, page 9)

As we've spoken with alumni and friends over the last few years, they're often surprised to learn how the College has changed—about its educational innovations, the impact of our research and the scope of our programs. They're also very proud of the changes, and have expressed the desire to get involved.

This is an exciting time for our College. Our students and faculty are doing tremendous work and we want to make our alumni and friends part of it. We've just hosted our first Alumni & Friends Weekend, and we keep receiving requests to make this an annual event. We've recently started a society for our alumni and friends, and the society's leadership is eager to help us achieve our vision, stated below.

The College's vision is a bold one, but it's one we work toward every day. It provides us with a sense of purpose, and of who we are.

Our vision is about impact. In this issue of *Scope* you'll see examples of the impacts our students and faculty are making. The cover story discusses modeling the spread of disease, a timely topic given concerns about an avian flu pandemic. A PAMS physicist has found a possible key to developing efficient fuel cells. Another faculty member is developing a faster way to develop life-saving drugs, while yet another continues to amaze the world with what she's learning from soft dinosaur tissue.

We're also making meaningful impacts in other ways. A recent economic development luncheon showcasing our faculty led to ongoing discussions with a local company about a potential partnership. In anticipation of an active hurricane season, we partnered with Congressman Bob Etheridge on a regional hurricane summit that presented the latest information about these dangerous storms and how to handle their aftermath. And we're at 87 percent of an ambitious $50 million fundraising goal that will provide support for our students, faculty and programs.

The College is doing great things, driven by a vision that is bold yet achievable. As our alumni and friends, you share in this vision. Your support, leadership and participation are very important to our students and faculty, and we are all very appreciative.

We hope to continue making you proud.

Daniel L. Solomon

Daniel L. Solomon, Dean

Vision Statement

We will continue our tradition of overall educational excellence and research quality while achieving world-wide prominence in strategically chosen areas—areas that are shaped by the national agendas for science, that build upon our strengths, and that offer opportunities to improve our economy, our environment and the human condition.

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scope

A LOOK INSIDE THE COLLEGE OF PHYSICAL AND MATHEMATICAL SCIENCES FALL/WINTER 2005

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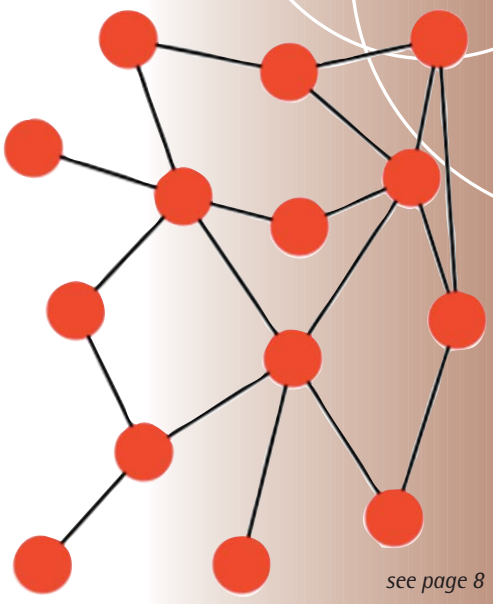

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PAMS Celebrate Achievement!
September 23–24, 2005

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On the cover: Mathematician Alun Lloyd sketches a network diagram on plexiglass. (Photo by Roger Winstead)

College announces new leadership

Paesler named head of Physics Department

Dr. Michael Paesler has been named head of the Department of Physics. He succeeds Chris Gould, who served as head for 10 years.

Paesler joined the NC State faculty as an assistant professor of physics in 1980 and was promoted to full professor in 1990. He has served as the director of graduate programs in physics since 1997.

Paesler's research focuses on synchrotron radiation investigations of chalcogenide glasses. Advances made in this effort may find applications in developing switchable computer interconnects.

While at NC State, Paesler has taken leave to serve as a guest professor at universities in France and Germany. He is a fellow of the American Physical Society (APS), a member of Phi Beta Kappa, Sigma Xi, and the NC State Academy of Outstanding Teachers.

This year Paesler was appointed to two national committees: the APS Task Force on Graduate Education and the American Association of Physics Teachers Graduate Education Committee.

Paesler received his bachelor's degree from Beloit College in 1968, and his PhD from the University of Chicago in 1975.

Paesler is believed to be the only NC State faculty member to have ever swum across the English Channel.

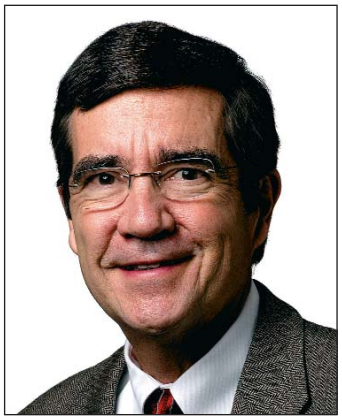


PHOTO BY ROGER WINSTEAD

Dr. Michael Paesler

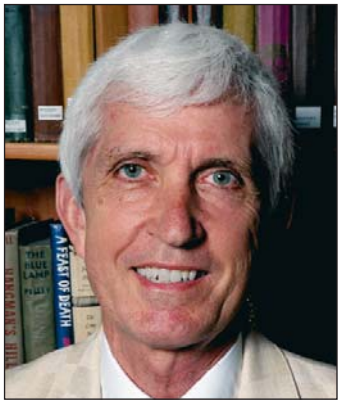


PHOTO BY ROGER WINSTEAD

Dr. Christopher Gould

Gould named associate dean

Dr. Christopher Gould has been named associate dean for administration for the College.

Gould served as head of the Department of Physics since 1995. He joined the NC State faculty as an assistant professor of physics in 1971, and became a full professor in 1983.

Gould is a nuclear physicist whose research focuses on the properties of neutrons and neutrinos. The work has applications in medical physics and in reactor safeguards, and has implications for the understanding of the matter anti-matter asymmetry in the universe, and the formation of heavy elements in stars.

Gould is a fellow of the American Physical Society, and a member of the Sigma Xi, Sigma Pi Sigma and Sigma Iota Ro honor societies. He was elected to the NC State Academy of Outstanding Teachers in 1985 and was recognized as an NC State Alumni Distinguished Undergraduate Professor in 1990.

He has held visiting appointments at Los Alamos National Laboratory, the Institute for Nuclear Physics in Frankfurt, Germany, and the Institute of Atomic Energy in Beijing, China. He currently serves on the fellowship committee of the APS Division of Nuclear Physics, and as chair of the Los Alamos Neutron Science Center Users Group.

Gould received his bachelor's degree from the Imperial College, London in 1965, and his PhD from the University of Pennsylvania in 1969.

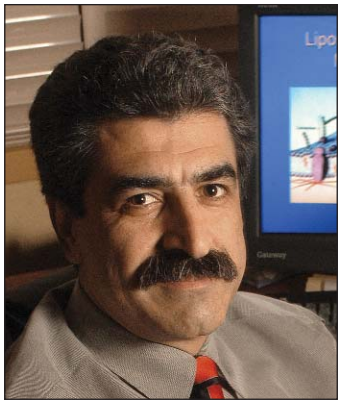


PHOTO BY ROGER WINSTEAD

Dr. Morteza Khaledi

He is spending fall semester as a Scholar in Residence at the Oak Ridge Center for Advanced Studies.

Khaledi named Chemistry chair

Dr. Morteza Khaledi has been named chair of the Department of Chemistry.

Khaledi joined the NC State faculty in 1988 as an assistant professor of analytical chemistry and was promoted to full professor in 1997. He is a member of the American Chemical Society and the national chemical honor society, Phi Lambda Upsilon.

He has served as a member of the scientific review panels for the National Institutes of Health (NIH) and on the editorial advisory boards of several journals. He has delivered more than 70 invited lectures at international meetings, symposia and workshops, and has published more than 100 scholarly articles.

A specialist in liquid and electrokinetic chromatography, Khaledi has received numerous grants from the NIH, including the FIRST Award in 1989.

Khaledi earned his bachelor's degree of science from the University of Shiraz in Iran in 1978, and his PhD from the University of Florida in 1984.

He succeeds Bruce Novak, who has returned to the faculty ranks after six years of service as department head. The department faculty recently voted to convert to a chairmanship structure.

Forecasting to save lives—PAMS hosts regional hurricane summit

The College and the Department of Marine, Earth and Atmospheric Sciences partnered with Congressman Bob Etheridge to present a hurricane summit on the first day of the 2005 hurricane season. The program was a follow-up to a similar summit held in 2001.

The summit provided an opportunity for emergency management professionals from both the public and private sectors to hear the latest information about hurricane forecasting research and technology.

Gen. David L. Johnson, director of the National Weather Service, was the keynote speaker. Presenters included representatives from the NC Division of Crime Control and Public Safety, NC Division of Emergency Management, the Severe Storms Lab and local news media.

NC State panelists included Drs. Len Pietrafesa and Lian Xie, and research associate Shaowu Bao, all of the Department of Marine, Earth and Atmospheric Sciences. During his presentation, Xie announced a new seasonal forecast model which features the first attempt to include landfall in specific regions. (See related story below.)

PHOTO BY SALLY RAMEY

Meredith Croke was one of several students who made poster presentations of their research projects at the hurricane summit. Here, she discusses her tropical cyclone precipitation research with summit participants during a break in the program.

Topics included public education and communications issues, and the state of various forecasting and modeling technologies, including flood models that will prove very helpful to emergency managers in planning response and recovery following major storms.

About 80 people attended the meeting, which included poster presentations by several meteorology students.

PAMS introduces new hurricane season prediction method

Just as the 2005 record-breaking hurricane season started, researchers at NC State announced a new model for predicting the number of hurricanes likely to form in the Atlantic Ocean, as well as the number of those hurricanes likely to threaten the eastern seaboard. This is the first attempt at a seasonal forecast that includes landfall in specific regions.

In an article published in a recent issue of *Geophysical Research Letters*, Dr. Lian Xie of Marine, Earth and Atmospheric Sciences, along with colleagues Dr. Leonard Pietrafesa and graduate student Tingzhaung Yan, describe the methodology they used in creating their prediction model as well as the results of their analysis. Also involved in the research were Dr. Dave Dickey of the Statistics Department, and Dr. Tom Karl of the NOAA National Climatic Data Center in Asheville.

The mathematical model evaluates data from the last 100 years on Atlantic Ocean hurricane positions and intensity, as well as other variables including weather patterns and sea surface temperatures, in order to predict how many storms will form and where they will make landfall.

"The most important factor in determining the probability of landfall was the temperature difference between the North and South Atlantic Oceans," says Xie. "When we looked at the histories of these storms we discovered that if the water in the North Atlantic was warmer than in the South Atlantic, landfall on the eastern seaboard of the United States became more likely."

Based on their data, the researchers believed that five to six hurricanes would form in the Atlantic during the June 1–Nov. 30 hurricane season. Of those, two to three were deemed likely to impact the eastern seaboard of the United States.

However, the 2005 season surprised everyone. As early as mid-July, those with established hurricane seasonal forecasts were updating their data to accommodate the higher level of activity. As of press time, 26 named storms had formed, using up the season's list of names and forcing meteorologists to use the Greek letters Alpha, Beta, Gamma, Delta and Epsilon as storm names. Of these storms, 14 became hurricanes, one of which, Wilma, became the most powerful Atlantic hurricane in history.

So how did NC State's new prediction method perform? At press time, there have been seven hurricanes that formed in the Atlantic, and two east coast landfalls—either within or close to the parameters of the new prediction method. Some of this season's many storms seemed to have formed in the Atlantic, but actually formed in the Caribbean.

This study is co-sponsored by the National Climatic Data Center and the Coastal Services Center of NOAA, as a component of the NOAA/NCSU Cooperative Program on Climate and Weather Impacts on Society and the Environment (CWISE).

Key geologic map updated

James P. Hibbard led efforts to revise an important reference map detailing major geologic features of the Appalachians from Alabama to Newfoundland. Hibbard is a professor in the Department of Marine, Earth and Atmospheric Sciences, specializing in structural geology and Appalachian tectonics.

While a graduate student at Memorial University of Newfoundland in 1978, Hibbard helped Dr. Hank Williams develop the original map, which identified major bedrock divisions in relation to their ages and the geologic environments in which they formed.

The first of its kind, this lithotectonic map became an important reference for geologists, mining companies, environmental scientists, university faculty and students, paleontologists—virtually anyone interested in the mountain chain's geology.

Since then, scientists have collected an incredible amount of additional information, Hibbard said, creating a new map with little resemblance to the old. Its main purpose remains as a reference for anyone interested in Appalachian bedrock geology.

For example, companies targeting granites of a specific age will better understand their distribution. Likewise, the map identifies the potential distribution of mineral deposits or even natural hazards such as sinkholes. Academics will find it useful in developing models for the distribution of continental masses at different time periods.

The new map is color-coded by age, with texture patterns distinguishing between major classifications of rock type. If one knows how to read the map, ancient shorelines are easily visible along the 8.5-foot map's 2,000-mile view.

"It's a storybook about the Appalachians," Hibbard said. "It provides regional geological context for the mountain belt. You can see how it was built."

While updating the map, the team made some unexpected discoveries, including a line of locations where Devonian granite has intruded up into older volcanic rock in North and South Carolina.

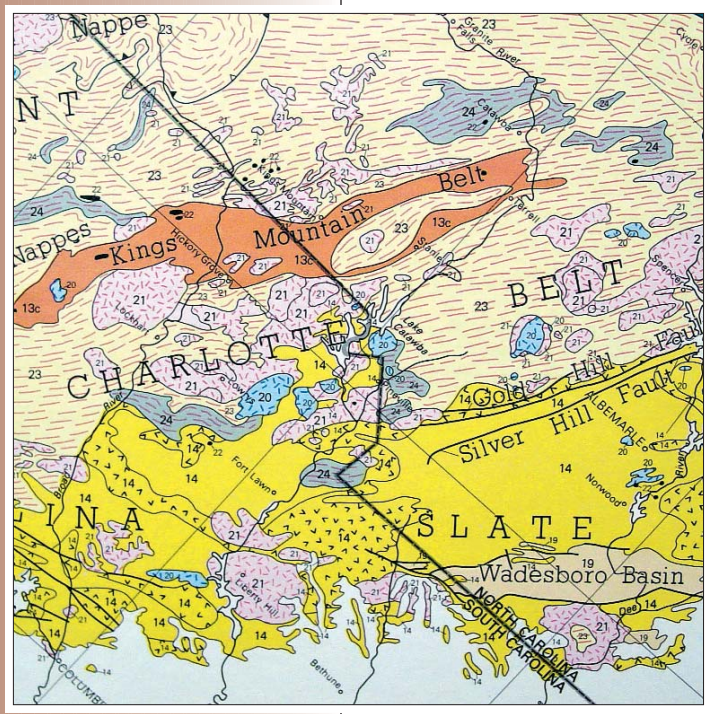
"This could represent the track of an ancient volcanic 'hotspot' that periodically erupted up through the continental crust as it moved across the hotspot, much like the hotspot that is now under Yellowstone National Park," he said.

Today's Geographical Information Systems (GIS) technology gave the map a new feature – digitization. Now, the map is a living document that can readily accept future revisions, or be manipulated into customized maps for research or educational purposes. It can serve as a GIS base map for virtually all types of geological data, including paleontological, geophysical, geochemical, geochronological, etc. Likewise, it can accept overlays of other data.

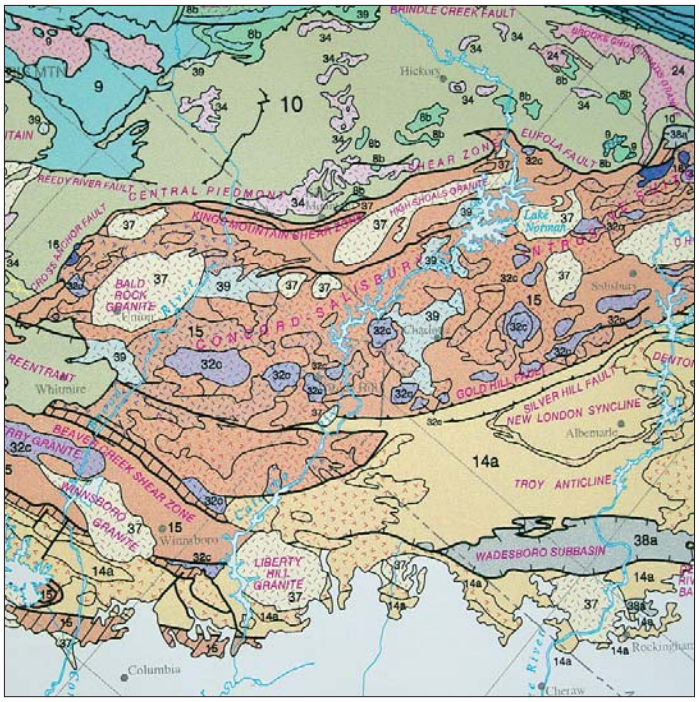
"The map's potential applications are endless, and not confined to geology. It gives meaning to a variety of data in the context of the mountain belt," Hibbard said. "Just as the 1978 map served as the basis and inspiration for research in the region, we hope the new map will stimulate research for years to come."

The five-year effort to revise the map involved a team representing NC State, the U.S. Geological Survey, the Canadian Geological Survey and the Memorial University of Newfoundland. The project was funded by the National Science Foundation.

PHOTOS BY SALLY PAMEY



This image is of a small section of the 1978 map.



This image is of the corresponding section of the new map. The additional detail is clearly obvious. The purple spots in the orange area across the middle of the image may be evidence of an ancient volcanic "hot spot."

‘Bob’ is a girl ... and she’s pregnant!

Paleontologist Mary Higby Schweitzer and her technician, Jennifer Wittmeyer, have determined that a 68 million year-old *Tyrannosaurus Rex* fossil from Montana is that of a young female, and that she was producing eggs when she died.

The scientists found unusual bone tissue lining the hollow cavity of a leg bone from “Bob,” a *T. rex* found in Montana’s Hell Creek formation. This is the same fossil in which the team had discovered remarkably well-preserved soft tissue appearing to contain blood vessels and possibly even red blood cells.

In a paper published in the June 3 issue of the journal *Science*, Schweitzer, assistant professor of paleontology with a joint appointment at the NC Museum of Natural Sciences, Wittmeyer, and colleagues at Montana State University said this particular tissue provides evidence of the dinosaur’s gender and a connection between the extinct giants and living birds, specifically ostriches and emus.

Schweitzer believes that the tissue inside the *T. rex* bone is medullary bone. This reproductive bone tissue forms inside the hollow leg bones of birds during ovulation and persists until the last egg is laid, at which time it is reabsorbed into the bird’s body. Its formation is triggered by an increase in estrogen levels, and it provides the calcium necessary to form eggshells. Medullary bone is only found in present-day female birds. No other egg-laying species produces this tissue naturally – including crocodiles, the other living dinosaur relative.

Because the dinosaur tissue didn’t look exactly like medullary bone in living birds like chicken and quail, Schweitzer’s team compared it to that of more primitive ratites, or flightless birds, such as ostriches and emus. These birds share more features with dinosaurs than other present-day birds.

Viewed under both a light and an electron microscope, the dinosaur tissues are virtually identical to those of the modern birds in form, location and distribution. Demineralization—the chemical removal of a bone’s minerals in order to obtain organic material that is much easier to work with in a lab environment—of the samples revealed that the medullary bone from the ostrich and emu was virtually identical in structure, orientation and even color, with that seen in the *T. rex*.

Since only females produce medullary bone, its presence indicates that “Bob” was actually a female, and probably died toward the end of her laying cycle. From a biological perspective, the tissue is another link between dinosaurs and living birds.

“The discovery of medullary bone in the *T. rex* is important because it allows us to objectively sex a dinosaur,” said Schweitzer. “It also adds to the robust support linking birds and dinosaurs and shows that their reproductive physiologies may have been similar. Hopefully we’ll be able to identify features within dinosaurs that will help us determine the gender of other fossils, and lead to more information about their herd structure or family groups.”

The NC Museum of Natural Sciences in downtown Raleigh recently became home to a cast of the thigh bone, making it available to the public to see.

This research was funded by NC State, the NC Museum of Natural Sciences and the National Science Foundation.

PHOTO BY SCARONE PHOTOGRAPHY

Schweitzer appears in “science fair” for Congress

Mary Higby Schweitzer was one of 38 researchers invited to present an exhibit at the Coalition for National Science Funding’s annual exhibition in Washington, DC Designed to encourage funding for the National Science Foundation (NSF), the event presents a selection of exhibits representing the variety of research funded by the NSF. The exhibition and reception are held for members of Congress and the White House staff. While there, Schweitzer also visited the offices of several NC legislators. Here, she talks with NC Sixth District Representative Howard Coble.

What about Bob?

The recent dual discoveries of soft dinosaur tissue, and the medullary bone described in this article, made headlines around the globe. Coverage of this research appeared in thousands of newspapers and magazines, and on radio, television...even *The Tonight Show* with Jay Leno. The subject matter allowed headline writers to be very creative. Here are some favorites:

NC State discovers *T. rex*’s softer side
Experts claim they found *T. rex* innards
T. rex breakthrough a grand ‘cell’ebration
Paleontologists are thrilled to the bone
Should we call her T-rexella?
Is *T. rex* really a boy named Sue?
Leaping lizards—dinosaur find awakens cloning dream
Dinosaur Meat Discovered
Dino-mite
Not Jurassic Park?
What Sex is That Rex?
No bones about it
What About Bob?
He rex or She rex?
Sex test for *T. rex*
GEE REX!

News Flash!
At press time, Schweitzer’s work was ranked #6 out of the top 100 science stories of 2005 in the January 2006 issue of *Discover* magazine.

Mathematics Department brings world to campus

Early this summer, the Merry Monk Room in North Hall was all abuzz with lively conversation in dozens of accents. Mathematicians from around the world had gathered at NC State for an international conference on "Lie Algebras, Vertex Operator Algebras and their Applications," and the evening reception was an opportunity to relax and socialize.

The program included speakers from Germany, France, Sweden, Japan and other nations, and was coordinated by Kailash Misra, professor of mathematics. The conference was partially funded by the National Science Foundation.

The event was just one way in which the Mathematics Department is an active participant on the world stage.

In recent months, the department also presented a special colloquium featuring world-renowned mathematician Peter Lax of New York University's Courant Institute of Mathematical Sciences. Lax was the recipient of the 2004 Abel Prize. The award, comparable to the Nobel Prize, is presented by Norway.

Lax is considered as one of the greatest pure and applied mathematicians of our time, and has made significant contributions, ranging from partial differential equations to applications in engineering. He is also one of the founders of modern computational mathematics.

"These activities provide our students a wonderful opportunity to be exposed to the best and brightest of our field," said Michael Singer, professor of mathematics. "International collaborations are becoming more important, and we have the quality programs, faculty and students to be a key player at that level."

The Department also received a grant from the National Science Foundation for a research and educational partnership between NC State and faculty and students at the Mathematics Mechanization Research Center of the Academy of Mathematics and Systems Sciences of the Chinese Academy of Sciences.

The project involves two workshops—one hosted by NC State and the other in Beijing—to explore collaborations. The Mathematics Department is represented in this effort by faculty members Hoon Hong, Erich Kaltofen, Michael Singer, Agnes Szanto and their students.

NC State hosted the first workshop this fall, which was attended by 10 Chinese participants. The Beijing workshop will be held in 2006.

"International cooperation is key in the sciences," said Singer. "And this is just an example of the international connections and collaborations in which our faculty are involved."

COURTESY OF MATHEMATICS DEPARTMENT

Several representatives of the Mathematics Department posed for a group shot of the Chinese delegation attending a workshop on campus. The NC State representatives are, as numbered from the left, 2) Wen-Shin Lee (Mathematics, PhD '01), 7) Dr. Irina Kogan, 9) Scott Pope, graduate student, 10) Alexey Ovchinnikov, graduate student, 11) Itnuit Janovitz, graduate student, 14) Dr. Michael Singer, 15) George Yuhasz, graduate student, 16) Dr. Hoon Hong and 17) Dr. Erich Kaltofen.

Mathematics student wins prestigious SIAM award

Mathematics student Rachel Levy won a student paper prize from the Society for Industrial and Applied Mathematics (SIAM). This is the first time any NC State student has won this prestigious competition.

The SIAM Student Paper Prizes are awarded every year to the authors of the most outstanding paper submitted to the SIAM competition. The award is based solely on the merit and content of the student's contribution to their paper. The purpose of the program is to recognize outstanding scholarship by students in applied mathematics or computing.

Among the three 2005 winners was Levy's paper titled "Kinetics and Nucleation for Driven Thin Film Flow." Michael Shearer, professor of mathematics, was co-author.

Levy is now a post-doctoral research associate in the Mathematics Department at Duke University.

SIAM was founded in 1952 to support and encourage the important industrial role that applied mathematics and computational science play in advancing science and technology.

‘Defective’ nanostructures may lead to hydrogen energy breakthrough

Scientists at North Carolina State University have discovered a nanoscale method for extracting hydrogen from water that requires only half the energy of current hydrogen production methods.

The researchers discovered that “defective” carbon nanotubes make it easier to “break” water molecules and extract hydrogen.

The discovery could have big implications, namely, lower hydrogen production costs, for industries looking to hydrogen as an alternative fuel.

The scientists, led by Dr. Marco Buongiorno-Nardelli of the Physics Department, published their results in the Sept. 30 edition of *Physical Review Letters*.

Carbon nanotubes are structures so small that it takes 1,000 of them stacked on top of one another to equal the thickness of a human hair. They have many potential uses, one being the ability to facilitate chemical reactions. Buongiorno-Nardelli’s team discovered that naturally occurring defects in the nanotubes can increase the rate of a chemical reaction, because the atoms that form the defective nanotubes are essentially “incomplete,” thus making them more reactive.

“Normally, when you talk about chemical reactions in carbon nanotubes, you’re imagining that these reactions are happening in perfectly formed nanostructures,” said Buongiorno-Nardelli. “But the reality is that these structures have defects—places where the carbon atom network is broken. And these defects can influence the chemical reaction.”

And that is what the scientists discovered when they began running computer models to simulate what would happen if they used the defective nanostructures to break water molecules. The current method for extracting hydrogen from water involves heating water molecules to 2,000 degrees Celsius. The high temperature “breaks” the molecule, and hydrogen is released.

“If you want to break a water molecule, you spend a lot less energy if you do it on this defective carbon material than if you do it by simply heating the molecule until it breaks,” Buongiorno-Nardelli said. “You can reduce the energy necessary by a factor of two – at less than 1,000 degrees.”

However, there are still problems to solve before a truly catalytic process can be devised – for example, how to make it viable for hydrogen production. The team hopes to collaborate with other scientists to design and construct a nanoscale chemical reactor that will one day lead to a cost- and energy-efficient way to produce hydrogen.

“We think that nanotechnology can be used to produce more and better energy in an environmentally friendly way,” says Buongiorno-Nardelli. “Our experience with water molecules so far leads me to believe we’re headed in the right direction.”

The research team includes Dr. Keith Gubbins, W.H. Clark Distinguished University Professor of Chemical and Biomolecular Engineering; post-doctoral researcher Milen Kostov; and students Erik Santiso and Aaron George.

Physicist assists in skin cancer discovery

When he was called about sharing his microscope, Bob Nemanich said yes. What happened next was an example of the great things that happen when scientists of different disciplines put their heads together.

Since 1930, the incidence of skin cancer has increased 2,000 percent in the United States. Lifestyle and ozone depletion have played a role in the increase, and one of the risk factors is being blonde or redheaded. These individuals are two to four times more likely than others to develop melanoma.

John D. Simon, a Duke University chemist, discovered that skin pigments in redheads react differently in ultraviolet light from those in people with dark hair. In fact, redheads’ pigments are more likely to create free radicals that harm DNA and possibly cause cancer.

This happens when photons of ultraviolet light are absorbed by microscopic pigment particles, a process that can knock loose electrons. With help from Nemanich’s photo electron emission microscope (or PEEM), this process, which had never before been observed, was documented and studied.

Simon and Nemanich are extending their research to microscopically examine pigment particles that occur in other places in the body, including the brain.

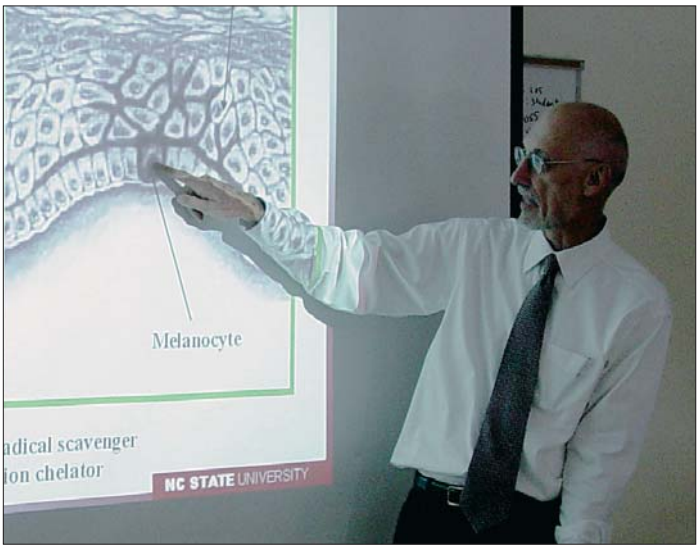


PHOTO BY SALLY RAMEY

Dr. Robert Nemanich describes the nanoscience behind a recent discovery involving redheads’ risk for skin cancer.

Visit www.pams.ncsu.edu/weekend to find a podcast of Dr. Robert Nemanich describing this work as part of a nanosciences presentation with chemist Dr. Chris Gorman at the PAMS Alumni & Friends Weekend.

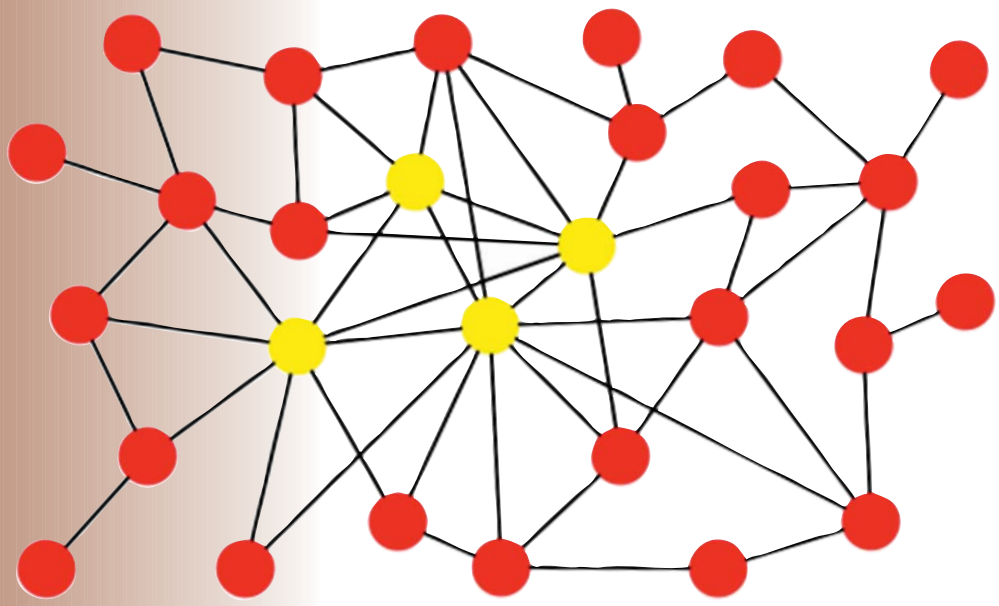
Mathematician models networks to

When we hear the word networking, most of us think of meeting professional colleagues or potential clients.

Some of us may think of the Internet, and how computers across the world are interconnected. Environmentalists may think of the network of interdependent species within a food web.

These are all examples of networks: they describe how individuals—whether people, computers or different species—interact with each other. This forms the basis of a rapidly growing area of mathematics known as network theory.

Infectious diseases have "known" about networks for a lot longer than mathematicians. Their spread from person to person depends on the pattern of interactions between the members of the population—the social network. Network models provide a way of describing how infectious diseases pass from person to person.



This image illustrates an example of a social network. The colored circles represent different people. Lines are drawn between people who interact regularly: they might be family members, friends or work colleagues. Notice that some people, highlighted in yellow, have many more interactions than others. Their larger social circle means that they would both be more likely to acquire an infection and more likely to pass that infection on to others. (Image courtesy of Alun Lloyd)

Movies about outbreaks of deadly diseases always seem to have a scene featuring a large, computerized map. "This is what we can expect in 24 hours, 48, 72…," a lead character says, and the map shows red splotches that spread out from the nation's cities into the countryside.

This is not far from the truth, according to Alun Lloyd, associate professor of mathematics at NC State and a member of its graduate program in biomathematics. Lloyd uses network approaches to describe the spread of infectious diseases. He said that mapping the spread of a disease across a region is a helpful way to visualize what is going on during a disease outbreak.

> *"If you can identify and control the hubs of activity, you can better manage the spread of the problem."*
>
> *— Alun Lloyd*

"Mathematical models that predict the spread of pathogens within a population can help us design better control measures for outbreaks of disease or bio- or agri-terrorism," said Lloyd. "They also can highlight the features of populations that can potentially lead to rapid spread of an infection."

Lloyd's work is part of several interdisciplinary projects funded by state and national homeland security agencies, and other health organizations. Seeking to develop a better understanding of networking and to produce better predictive models, he works with mathematicians, statisticians, public health experts, veterinarians, ecologists and anthropologists.

The wide range of disciplines is necessary because networking is based on behavioral characteristics, which makes the research very complex.

"To develop good models, we must understand the movement of people within a population or society, even the economic factors that affect this movement," Lloyd said. "In animals, we must understand the relationships between predator and prey, and how specific diseases behave in those populations."

In people, a disease may be spread from person to person and can involve a range of transmission venues—a simple handshake, a cough or an exchange of bodily fluids. Or, in agri-terrorism, one possible tactic might be to contaminate the food supply or deliberately infect animals with some pathogen. This could happen at a farm, at a supermarket or at any point in the supply chain.

Different points of introduction or the use of different pathogens create different networking patterns, but most could be accommodated in models that predict the spread of disease within a population.

"In infectious disease, often the most important people to treat are those who are most connected to others because they are both more likely to catch the disease and have more opportunities to spread it," Lloyd said. "They act as activity hubs."

For example, an airborne pathogen can be quickly spread by someone who has multiple contacts with people. Think about a checkout clerk at a grocery store, or a salesman making calls on multiple clients. In a sexually transmitted disease, the most promiscuous individuals are more likely to spread it, but certainly not at a rate comparable to a salesman spreading an airborne pathogen.

predict spread of disease

There are similarities between infectious disease and computer viruses—servers with more connections to others are more likely to spread viruses.

"Network models can also predict spread of problems in other arenas, such as the nation's food supply or on the electric utility industry's power grid," Lloyd said. "In each situation, if you can identify and control the hubs of activity, you can better manage the spread of the problem."

While mathematical models can help predict spread within a given population, or a system with known, predictable connections, such as the power grid, it is more difficult to predict spread between populations.

"It's more unpredictable how a disease may move across oceans or between cities," Lloyd said. "But one thing is clear: intercontinental airline travel makes it much easier for infections to sweep across the globe. We saw this during the 2003 SARS outbreak, with rapid spread of SARS from China to other far Eastern countries, and then across the world."

PHOTO BY ROGER WINSTEAD

Dr. Alun Lloyd

It only takes a few infected people taking long-haul plane journeys to turn the planet into a "small world," bringing Toronto and Beijing closer together than their geographical separation might suggest. In many ways, this is the same phenomenon that underlies the "Six Degrees of Kevin Bacon"' game: through a series of connections through friends, family, coworkers and other colleagues, most of us are only a few steps away from knowing a celebrity or other famous figure.

There is a lighter side to networking models. They can be used to gain better understanding of the spread of cultural ideas, rumors or even fashion trends.

"The recent trend of wearing baseball caps backwards was started somewhere by someone, and now it's quite common," Lloyd said.

And what about "Six Degrees of Separation?" It turns out that there is mathematical truth to the idea, expressed in this 1990 play and subsequent 1993 film, that everyone in the world is connected by a series of only six acquaintances.

"Occasionally, long-range associations quickly connect the seemingly distant worlds in which people live. We truly do live in a 'small world,'" Lloyd said.

Faculty/Staff Notables

Ralph Smith (Mathematics)—Associate Director of Statistical and Applied Mathematical Sciences Institute

Roger Woodard (Statistics)—Waller Education Award from the American Statistical Association

Marie Davidian and **Zhao-Bang Zeng** (Statistics)—William Neal Reynolds Professors of Agriculture and Life Sciences

Marie Davidian (Statistics)—Alumni Distinguished Research Award

Tom Reiland (Statistics)—Alumni Distinguished Undergraduate Professor Award

Dennis Boos and **Leonard Stefanski** (Statistics)—D.D. Mason Faculty Award

Statistics Department—NC State Departmental Teaching and Learning Excellence Award

New research building opens

Partners III

About 250 people got an inside glimpse into the latest cutting-edge research at an open house for Partners III, a new research building on Centennial Campus.

PAMS hosted the open house in partnership with the College of Agriculture and Life Sciences, which shares the building.

PAMS' nanosciences research programs from the Chemistry and Physics departments occupy about three-fifths of the building and include the surface science laboratory, nanotribology laboratory, the nuclear magnetic resonance spectroscopy laboratory, the Center for High Performance Simulation, and others.

The open house was held in conjunction with the 20th anniversary celebration for Centennial Campus.

Attendees included elected officials, research partners, members of the campus community and the general public. They were able to tour several labs and visit with faculty and students about their research.

Statistician leads effort to faster drug discovery

Jacqueline Hughes-Oliver, associate professor of statistics, has received a $747,000 grant from the National Institutes of Health (NIH) to launch a research project devoted to helping scientists discover new drugs more efficiently.

Her research team seeks to develop statistical and computational methods to identify compounds that may be developed into medicines.

Being able to model relationships between chemical structure and reactivity creates an important shortcut in the normally time- and labor-intensive drug discovery process. Instead of trial-and-error, scientists can use computer modeling to determine more quickly what chemicals hold promise for use in disease-treating medications.

This increase in efficiency would allow scientists to develop drugs more quickly, and increase the number of drugs being considered at a given time.

Because this process would be quicker and cheaper than conventional drug discovery, it may also lead to decreased costs that may be passed on to patients. More importantly, it would make drug discovery efforts for rare diseases more cost-effective for pharmaceutical companies to pursue.

"This effort is the newest example of our department's 64-year commitment to interdisciplinary research," said Sastry Pantula, department head. "This initiative will bring chemists and computer scientists together with statisticians to work as a team on important scientific problems."

Other NC State faculty members involved in the research include Dr. Morteza Khaledi of the Chemistry Department, Dr. Robert Funderlic of the Computer Science Department, and Dr. Gary Howell of the Information Technology Division.

This work was funded by the National Institutes of Health through the NIH Roadmap for Medical Research. Information on the Molecular Libraries Roadmap Initiative can be obtained from http://nihroadmap.nih.gov/molecularlibraries/.

PHOTO BY ROGER WINSTEAD

Dr. Jacqueline Hughes-Oliver

PHOTO BY MARCIA GUMPERTZ

This group of statistics students enjoyed a visit to the Bureau of Labor Statistics.

Statistics Club visits alumni, agencies in Washington, DC

On an average day, what percentage of all trips taken in the nation involve public transit: 1.6%, 3.5%, 9.8%, or 16.7%? (see answer below)

The NC State Statistics Club learned the answer to this and other questions during a visit to the Bureau of Transportation Statistics in Washington, DC

Each year the club visits two federal agencies, tours important sites, and dines with DC-area NC State alumni. Other agencies visited in the past have included the Food and Drug Administration, Bureau of Justice Statistics, Census Bureau and Bureau of Labor Statistics.

Professionals at each agency describe their work, the roles statisticians play in their organizations, the types of statistical methods they use, the types of reports they produce, and share other information.

The trip was topped off by dinner with NC State alumni B.J. George, Jennifer Lawhorn, Pam Sims and Ming Xiong. The students and alumni particularly appreciated that American Statistical Association Executive Director Bill Smith and his wife, Patricia, joined them for dinner.

This annual trip is an excellent opportunity for statistics undergraduates to visit federal agencies and meet with local alumni. If you're an NC State alumnus in the DC area, or a statistician at a federal agency or DC company, and would like to get involved, please contact Marcia Gumpertz at gumpertz@ncsu.edu.

Answer: 1.6%

New genome map may aid disease research

A team of international scientists, including Bruce Weir of NC State, has created a "map" of the human genome that will help scientists find the genetic causes of common diseases like diabetes and Alzheimer's.

Weir is one of more than 60 scientists from around the world involved in the effort to create a haplotype map, or "HapMap," of the human genome—a map that pinpoints genetic differences between people. The researchers' findings appear in the Oct. 27 issue of the journal *Nature*.

A haplotype is a short piece of a chromosome. Human DNA contains 23 chromosomes, and these chromosomes are almost identical from person to person. However, there are places along the genome—the genetic content within these chromosomes—where variations occur. Scientists refer to these positions along the genome as SNPs (single nucleotide polymorphisms) or "snips."

The aim of the HapMap is to provide scientists and medical researchers with "addresses" along the map that will show them where these genetic variations occur.

"Most of our diseases have a genetic component," Weir said. "We need to find out what these genes are, and to do that we first must discover where they are. The HapMap basically identifies landmarks along the chromosomes so that researchers can eventually find the genes responsible for diseases like Alzheimer's, diabetes and others."

These results represent the end of the first phase of the International HapMap Project, a study of the genetic constitution of 269 people of varying ethnicity: 90 people of European descent, 90 members of the Yoruba tribe in Nigeria, 45 Chinese residents of Beijing and 44 Japanese residents of Tokyo.

A partnership of scientists from Canada, China, Japan, Nigeria, the United Kingdom and the United States began the project in 2002. The researchers' findings are available to the public via their Web site: www.hapmap.org.

"Most of our diseases have a genetic component. We need to find out what these genes are, and to do that we first must discover where they are."

— Bruce Weir

As a statistician, Weir's role in the HapMap project was to help make sense of the raw data. "Basically, we had all these numbers and letters in a giant computer file of data," he said. "Our team needed to figure out how this data should best be organized in order to help other scientists and researchers use it, and then to do the organizing.

"Phase I of the HapMap project identified 1 million SNPs," Weir said. "We believe that there are 10 million total positions along the genome where variations occur, but that identifying a fraction of them should be sufficient for our purposes. One of the HapMap goals is to identify that fraction."

Phase II of the HapMap project should be finished in the near future. There are also plans to extend the study to other world populations. Weir is excited about the future ramifications of the project.

"This is really big science—60 scientists from around the world working toward a common goal that will have a huge impact on mankind," Weir said

PHOTO BY ROGER WINSTEAD

Dr. Bruce Weir

Weir receives Holladay Medal

Bruce Weir was one of five 2005 recipients of the Alexander Quarles Holladay Medal for Excellence in recognition of his outstanding career at NC State.

The Holladay Medal is the highest honor bestowed on a faculty member by the trustees and the university and recognizes the contributions of faculty members in teaching, research and service.

Weir built an international reputation in population genetics during his 29 years at NC State. His pioneering work in statistical genetics has broad impacts, ranging from plant and animal breeding to bioinformatics and DNA forensics.

He is the founding director of NC State's Bioinformatics Research Center, and he established the bioinformatics graduate program. He also initiated the Summer Institute in Statistical Genetics, which provides training for scientists in locations around the world.

Weir received his PhD in statistics from NC State in 1968.

Weir is a Fellow of the American Statistical Association and the American Association for the Advancement of Science and an Honorary Fellow of the Royal Society of New Zealand. His numerous awards include the Guggenheim Fellowship, the O. Max Gardner Award, the Kriz Study Award, D.D. Mason Award, USDA Superior Service Award for Scientific Research (Group Award), Alumni Outstanding Research Award, Cook Memorial Prize for Mathematics, and Fulbright Travel Grant.

PAMS hosts successful Alumni & Friends Weekend

More than 180 people attended the first PAMS Alumni & Friends Weekend, held Sept. 23–24. This special program offered something for everyone – fun, fellowship and education.

PHOTO BY SALLY RAMEY

Luncheon attendees varied by age, and included families.

Kick-Off Luncheon

The weekend began with a Kick-Off Luncheon in the beautiful three-story atrium of the Marye Anne Fox Undergraduate Science Teaching Laboratory.

Attendees gathered on the first floor and enjoyed sparkling lemonade and social time with old and new friends, before moving upstairs to the mezzanine level for the luncheon.

As part of the program, Dean Daniel L. Solomon announced the kick-off of the public phase of the university's capital campaign (see related story, page 16). The audience then saw the premiere of a special video developed to tell the College's story to both prospective students and potential supporters.

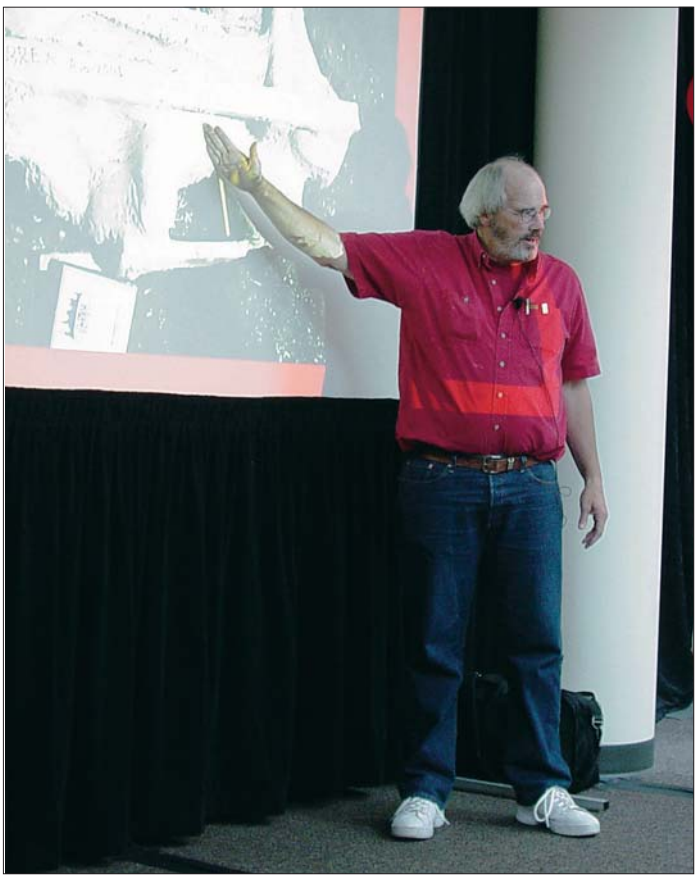


PHOTO BY SALLY RAMEY

The luncheon keynote speaker was world-famous paleontologist Dr. John "Jack" R. Horner, Regents Professor of Paleontology at Montana State University and Curator of Paleontology at Museum of the Rockies in Bozeman, Montana.

As funny as he was informative, Horner described the basics of how to find and dig up dinosaur fossils. He then told the story of how "Bob" the *T. rex* was found. This particular *T. rex* was the one in which NC State paleontologist Mary Schweitzer found soft dinosaur tissue, a discovery that wowed the world earlier this year (see related story, page 5).

"Bob" was named after the person who first spotted the *T. rex*'s toe bone sticking out of the side of a cliff.

"I thought I'd taught him better," Horner said, as he clicked to a slide showing Bob hacking away at the rock…while standing on a folding chair … precariously perched on a pile of rocks … on a ledge … on the side of a mountain.

Horner may be best known as advisor for Steven Spielberg's three "Jurassic Park" films, and as the basis for the films' main character, Dr. Alan Grant. Horner's groundbreaking perspectives on dinosaur behavior changed the face of modern paleontology.

During a brief Q&A session, he was asked, among other things, how realistic he thought the "Jurassic Park" movies were.

"It was a good movie, and good movies are fictional, so I don't have a problem with those," Horner replied, then added, "I know that a *T. rex* would eat lawyers," referring to a scene in the first movie.

Alumni & Friends College

After lunch, it was time to rush off to class. Attendees had been able to select three classes from a series of 12 special topics.

Here, Dr. Jack Horner describes why the *T. rex* leg bone had to be cut before it could be lifted from the dig site by helicopter. The fortuitous event led to Dr. Mary Schweitzer finding soft dinosaur tissue preserved inside the leg.

PHOTO BY SALLY RAMEY

In "Classroom of the Future," Rita Bigham and Connie Moreadith use a calculator to figure out how many paces it takes to walk across the country.

Faculty members from all five departments presented short lectures and discussion sessions, some involving interactive exercises. Topics ranged from financial mathematics to global warming and from nanoscience to dinosaurs.

"The classes provided an opportunity to appeal to the natural curiosity that attracts people to our disciplines," said Anita Stallings, executive director of development and college relations. "Our alumni and friends continue to enjoy learning long after they've left college."

Some attendees saw first-hand how today's classroom is different.

"I wasn't prepared for active participation in the classroom demonstrations," said one participant. "After the initial shock, I liked that part of the classes best."

Overall, participants had very positive reports on their classroom experiences, and to our knowledge, no one skipped class.

Friday Night Evening Social

That evening, participants and College faculty gathered at the University Club for a department-hosted reunion social, which featured a photograph display, heavy hors d'oeuvres, beverages and live beach music and oldies by The Entertainers.

"While several people enjoyed dancing, many preferred to talk," Stallings said. "Next year, we'll provide ample opportunities for conversation."

Saturday Gametime Gathering

Weekend participants without tickets to the NC State/UNC football game were invited to a gametime gathering in a private room at Jillian's sports club in downtown Raleigh.

Lawrence Ives (Physics '73, '76, '84) had said he was going to stand on the side of the road near the stadium in hopes of finding a spare ticket. He thought better of this plan and showed up at Jillian's.

"I decided I'd rather watch the game with friends," he said.

And considering the bad luck experienced by the Wolfpack, everyone needed the support and camaraderie of friends.

PHOTO BY SALLY RAMEY

Drs. Len Pietrafesa and Lian Xie discussed current research into hurricanes, including the dangerous flooding left in their wake. Here, Pietrafesa explains how hurricanes distribute heat across the globe, a critical process that provides an overall temperate environment in which humans can live.

What about next year?

Throughout the Weekend, participants requested that the College present such a program again. An online survey provided overwhelmingly positive evaluations, and suggestions were enthusiastic and constructive.

The following responses were typical of those received through the survey:

"This event was a great idea, and a way to get alumni reconnected to the University and PAMS. I thought the planning was tremendous. The faculty did a great job preparing, and teaching during the courses."

"Overall, the Friday luncheon and sessions were wonderful. I really enjoyed getting back on campus and seeing old friends and colleagues. Thanks!"

"My wife and I were thoroughly impressed with all the things PAMS has accomplished and continues to accomplish. It is really great to show off what is happening there. We congratulate you ... Thanks for including us."

"Clearly, our alumni and friends do want to see this grow into an annual event," Stallings said. "This is very exciting, and we're already planning for next year."

Weekend photos and podcasts online now

Visit www.pams.ncsu.edu/weekend, and you'll find links to a photo gallery from the Alumni & Friends Weekend. You may spot yourself or some familiar faces.

At this site, you'll also find audio podcasts of three classes from the Alumni & Friends College.

The podcasts can be played with any general media player on your computer. The three podcasts include the following topics:

- "The new frontier of nanoscience," featuring chemist Chris Gorman and physicist Bob Nemanich
- "How search engines work," with Carl Meyer of the Mathematics Department
- "PAMS—Wow, have things changed," presented by Dean Dan Solomon

The podcasts are accompanied by related PowerPoint presentations. After listening to the podcasts, please complete the online evaluations.

PHOTOS THIS PAGE BY SALLY RAMEY

Seth Hudson and Cecily Turner enjoyed their visit back to campus.

In "Not Your Daddy's Science Class," David Haase described some of today's innovative approaches to science and mathematics instruction that have changed K–12 schools. Haase is director of The Science House, which partners with K–12 schools to enhance science and math education.

Jack Penny, Greg and Leigh Wilkinson and Hien Tran (standing) are not pleased by the progress of the football game.

Thanks to Alumni & Friends College faculty

The following faculty prepared and presented special lectures for the first Alumni & Friends College.

How Google works— *Carl Meyer, Mathematics*

Are your investments safe?— *Jean-Pierre Fouque, Mathematics*

The new frontier of nanoscience— *Chris Gorman, Chemistry and Robert Nemanich, Physics*

The Galapagos: Islands of change— *John Morrison, Marine, Earth and Atmospheric Sciences*

Not your daddy's science class!— *David Haase, Physics; The Science House*

Environmental statistics: A new source of discovery— *Bill Hunt and Kim Weems, Statistics*

Hurricane!— *Len Pietrafesa and Lian Xie, Marine, Earth and Atmospheric Sciences*

Global warming: Fact or fiction?— *Fred Semazzi, Marine, Earth and Atmospheric Sciences; Mathematics*

CSI: Raleigh— *Chris Basten, Statistics, Bioinformatics Research Center*

Dinosaurs: Secrets revealed— *Julia Clarke and Mary Schweitzer, Marine, Earth and Atmospheric Sciences*

Classroom of the future— *Bob Beichner, Physics and Maria Oliver-Hoyo, Chemistry*

PAMS: Wow, have things changed!— *Daniel Solomon, Dean*

Welcome to PAMS Alumni & Friends Society

If you're reading this, you're probably already a member!

After a two-year process of obtaining ideas and suggestions from a large number of alumni and friends, the College has established an Alumni and Friends Society.

The purpose of the Society is to develop relationships with alumni and friends through new and existing initiatives and to enhance, promote and support the College's teaching, research and outreach programs.

The Society is guided by a board of advisors. That board includes Cindy Clark, Bill Donovan, Floyd Green, Scott Guthrie, Bill McClenny, Wayne Pace, Jack Penny, Kimberly Potter, Pam Pittman Robinson, Chuck Wachtel and Bill White. Also on the board are Leigh Wilkinson, president, Benton Satterfield, Jr., vice president and Carl Allen, secretary.

"The Society is already off to a great start," said Denise Hubbard, Director of Development. "They formed a task force that provided input, promotions and staffing for the first Alumni & Friends Weekend, and several members attended a welcome dinner for Dr. Jack Horner, hosted by our outgoing Foundation president, Connie Moreadith."

The Society board plans to expand involvement opportunities for the College's alumni and friends. This includes student recruitment events and the next Alumni & Friends Weekend.

"We are so excited about the enthusiasm of the board and task force members," Hubbard said. "These individuals truly understand what a difference they can make in helping the College achieve its vision, which will benefit students for years to come."

Anyone who has attended the College is automatically a member of the Society. Any non-alumnus who has made a financial contribution to the College is automatically a member. Other non-alumni who wish to join as a friend may apply for membership by completing an application.

More information may be found at www.pams.ncsu.edu/society.

PAMS presents economic development "Achieve More Field Day" luncheon

In collaboration with the NC State Economic Development Partnership and the Council for Entrepreneurial Development, the College recently participated in the Achieve More Field Day luncheon series.

This outreach program allows NC State colleges to showcase research areas that promise to impact future economic development. Attendees include venture capitalists, patent attorneys, investors and serial entrepreneurs.

The College was represented by Drs. Jacqueline Krim and Robert Nemanich of the Physics Department, and Drs. Dan Comins and Jon Lindsey of the Chemistry Department. Each spoke about their particular area of research, and its possible future applications.

For example, Comins described how the nicotine molecule could be used to provide short-cuts in the synthesis of certain compounds of commercial value, leading to quicker, simpler and cheaper production.

About 60 people attended the program, and many lingered afterward to have more detailed discussions with the speakers.

"This was a new experience for the College, and it seems to have produced concrete results," said Dean Daniel L. Solomon. "One of these faculty members is now in discussions with a company about a specific project, and that came about as a direct result of the luncheon program."

PHOTO BY SALLY RAMEY

Following the Achieve More Field Day luncheon, faculty presenters visit with participants.

PAMS Campaign Committee

Eric Bigham
Charles Case
Eric Doggett
Suzanne Gordon
Julie McVay
Connie Moreadith
Emily Mann Peck*
Mike Peirson
Ginger Sall*
John Sall*

**Co-chairs*

Bob Jordan – Liaison, University Committee

Campaign Kick-Off Task Force

Carl Allen
Cynthia Clark*
Maureen Droessler
Joe Hackley*
Connie Moreadith
Glenn Osmond
Lynn Osmond
Emily Mann Peck
Tom Rhodes
Nancy Ridenhour
Benton Satterfield, Jr.
Bob Starbuck
Bill White

**Co-chairs*

University, PAMS announce Achieve! Campaign

NC State recently announced Achieve! The Campaign for NC State, an historic, $1 billion university-wide fundraising effort that will ensure our ability to transform lives for generations to come through truly innovative teaching, research, extension and public service.

Private gifts raised during this campaign will be used to allow the university to assume an even more dynamic role in shaping the future of our state, our country and the world.

PAMS made its campaign announcement at the Alumni & Friends Weekend Kick-Off Luncheon.

"It is important to the College that we build an endowment that allows us to remove barriers to higher education, as well as recruit students of exceptional merit," said Dean Daniel L. Solomon. "Private endowment will allow us to support faculty who teach and mentor students through classroom instruction and through opportunities to work in their laboratories, leading to advances that will improve the human condition."

To date, the College is at 87 percent of its $50 million goal, which is outlined opposite this page.

There have been several key achievements in the campaign. More than $4.2 million from alumni, friends, and corporate partners will provide scholarship and fellowship support for our students.

PAMS also has received gifts—from $500 to $50,000—from numerous individuals in response to a challenge grant that will provide $500,000 in endowment for the College's premier K–12 outreach program, The Science House.

Solomon also recognized supporters who have made generous contributions of $1,000,000 or more in support of programs and endowment:

- The North Carolina GlaxoSmithKline Foundation
- SAS Institute
- John and Ginger Sall
- The W. M. Keck Foundation

"Our vision is a bold and important one. My thanks to all of you who choose to invest in our vision," he said.

PAMS Campaign Committee Co-chair John Sall then spoke enthusiastically about the campaign, the College's progress toward its goal, and the quality of the College's programs. He held aloft a copy of the fall 2005 issue of the Alumni Association's magazine, *NC STATE*—which had a *T. rex* on the front.

"This is the campaign kick-off issue of the university's magazine," Sall said proudly. "And our college is on the cover."

While PAMS leads other NC State colleges in progress toward its goal, there is a critical need for endowment support—permanent funds that produce income in perpetuity to support undergraduate and graduate students, faculty and programs. Endowed funds are among the most important resources any university can have, providing a source of support that is stable, stimulates innovation and ensures the future progress of an institution.

Anita Stallings, executive director of development and college relations, said, "We're pleased with our progress in meeting current needs goals. Our greatest challenge will be to meet the endowment objectives in each category. Of our $50 million goal, $12.5 million is targeted for building the PAMS endowment. If successful, we will more than double the endowment for the College, compared to the balance at the beginning of the campaign."

If you are interested in making a gift, or learning more about various gift options, please see "How to make a gift," opposite this page.

achieve!
The Campaign for NC State

Fellowship honors Skip Stoddard

Dr. Edward "Skip" Stoddard received a nice surprise recently.

Unknown to him, several of his friends, colleagues, associates and former students established the Skip Stoddard Student Research Fellowship endowment in the NCSU Physical and Mathematical Sciences Foundation.

"I think it's wonderful. I'm flattered," he said. "And I'm surprised that they kept it secret."

Awards supported by this fund will honor Stoddard's 30-year career and recognize his devoted service to geology students in the Department of Marine, Earth and Atmospheric Sciences. He will retire in 2006.

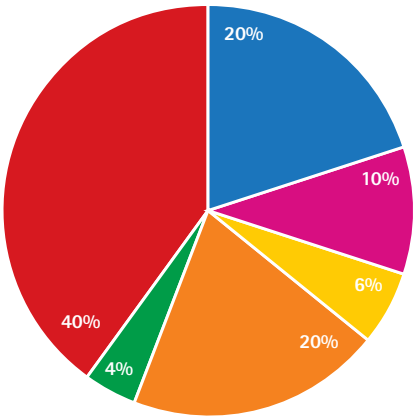
Specifically, the fund will provide support for either upper-level undergraduate geology majors or graduate students who require support for field expenses, special analytical work, or supplies for completion of research.

"These funds will really be beneficial," Stoddard said. "With the types of field and analytical work our students do, sometimes you need just a little bit of additional support to do one more study to finish a research project."

Anyone wishing to contribute to this fund may follow the instructions in "How to make a gift," located opposite this page.

PAMS Campaign Goals

Increasing private support for students, faculty, research, and outreach programs is critical to achieving our vision. Our objective is to raise $50 million for the following goals, which were determined by teams of faculty, alumni and friends.



	Endowment	Current Needs
Undergraduate and graduate student support $10 million will double the current level of support, providing resources to compete for talented students and meet financial needs	$ 6,500,000	$ 3,500,000
Faculty support $5 million will endow professorships to recruit and retain distinguished teaching and research faculty	5,000,000	
The Science House/K–12 Outreach $3 million will create an endowment to provide permanent support for The Science House, and fund current teacher training and student science programs	1,000,000	2,000,000
Facilities and equipment $10 million will leverage existing construction funds to support modern instructional methods and technologies		10,000,000
Unrestricted support $2 million in flexible, current gifts will allow us to respond to exciting opportunities, urgent needs and unexpected challenges		2,000,000
Research and Program Development $20 million will enable us to conduct research and develop academic programs leading to discoveries and knowledge that enhance quality of life and stimulate economic development		20,000,000
Total	$12,500,000	$37,500,000

Total Campaign Needs **$50,000,000**

How to make a gift

You may remember how difficult it was to manage the expense of higher education. You may want to help today's students achieve their dreams.

The PAMS Foundation provides many ways to support students, faculty and programs of the College. Whether you want to contribute to an existing scholarship, support a departmental enhancement fund, make a memorial gift, or consider more significant support, our staff is available to help you explore the options.

To support existing funds

To contribute to a scholarship, fellowship or other fund, fill out our secure, online gift form at www.css.ncsu.edu/pams/ or mail a check to the NCSU Physical & Mathematical Sciences Foundation, Campus Box 8201, Raleigh, NC, 27695. Make checks payable to PAMS Foundation and write the name of the fund on the "notes" or "for" line.

If your employer provides matches for charitable donations, please send a completed matching gift form with your contribution.

There are many funds not mentioned in this issue of *Scope*, and several have specific designated uses. If you would like information on our various funds to help you decide the best fit for your support, please give us a call at 919-515-3462. For a list of funds, visit www.pams.ncsu.edu/development/funds.php.

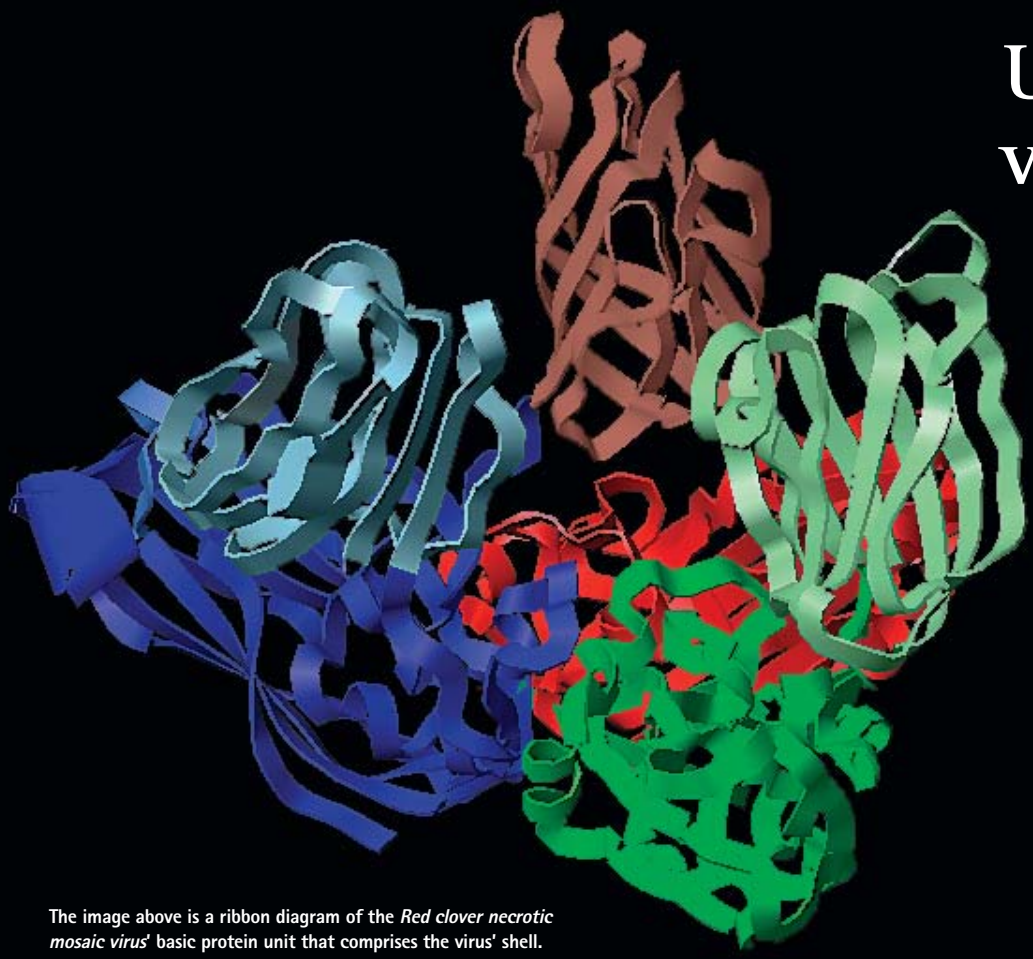
To explore other options

If you have questions about gift planning, we can help you identify tax benefits, choose between permanent endowment vs. one-time support, and explore estate planning or life-income options.

There are many ways to match your interests with specific College needs, and several possibilities for making your vision a reality. Whether using cash, appreciated assets, real estate or a bequest, we can help you find the best way to make the most of your gift.

Contact us today at 919-515-3462 or by e-mail at pamsalumni@lists.ncsu.edu.

Understanding viral dynamics



The image above is a ribbon diagram of the *Red clover necrotic mosaic virus*' basic protein unit that comprises the virus' shell. The image was generated in MOLMOL software, based on a cryo-EM reconstruction by Smirnova's research colleague Dr. Michael Sherman, Department of Molecular Biology, University of Texas Medical Center, Galveston. Sixty copies of this basic unit form the complete virus shell structure.

Viruses are intricate molecular machines composed of multiple copies of proteins and nucleic acids that perform complex functions, including self-assembly, nucleic acid packaging and cell recognition. These attributes make them ideal for use in medical applications. Viruses are highly flexible and undergo structural changes, depending on physiological conditions. This flexibility plays a key role in the process of infection, and may prove helpful in using viruses as cell-specific "delivery cages" for medications.

Dr. Tatyana Smirnova of the Chemistry Department, in collaboration with Dr. Steven Lommel of the Department of Plant Pathology, is using novel spectroscopic methods to monitor viral motion as they undergo structural changes. Funded by the National Science Foundation, this research program aims to gain better understanding of the molecular mechanism of metal ion-induced structural transformations observed in plant viruses.

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